In like manner fresh-water and estuarine conditions are found now in one region, now in another, throughout all the formations or groups of formations possibly from Silurian times onward; and glacial phenomena, so far from being confined to what was and is generally still termed *the* Glacial Epoch, are now boldly declared, by independent witnesses of known high reputation, to begin with the Cambrian epoch, and to have occurred somewhere, at intervals, in various formations, from almost the earliest Palæozoic times down to our last post-Pliocene 'Glacial Epoch.'

If the nebular hypothesis of astronomers be true (and I know of no reason why it should be doubted), the earth was at one time in a purely gaseous state, and afterwards in a fluid condition, attended by intense heat. By-and-by consolidation, due to partial cooling, took place on the surface, and as radiation of heat went on, the outer shell thickened. Radiation still going on, the interior fluid matter decreased in bulk, and, by force of gravitation, the outer shell being drawn towards the interior, gave way, and, in parts, got crinkled up, and this, according to cosmogonists, was the origin of the earliest mountain-chains. I make no objection to the hypothesis, which, to say the least, seems to be the best that can be offered, and looks highly probable. But, assuming that it is true, these hypothetical events took place so long before authentic geological history began, as written in the rocks, that the earliest of the physical events to which I have drawn your attention in this address was, to all human apprehension of time, so enormously removed from these early assumed cosmical phenomena, *that they appear to me to have been of comparatively quite modern occurrence, and to indicate that from the Laurentian epoch down to the present day, all the physical events in the history of the earth have varied neither in kind nor in intensity from those of which we now have experience.* Perhaps many of our British geologists hold similar opinions, but, if it be so, it may not be altogether useless to have considered the various subjects separately on which I depend to prove the point I had in view."

II.—United States Geological and Geographical Survey of Colorado and Adjacent Territory, 1876. By F. V. Hayden, United States Geologist. 8vo. (Published at the Government Printing Office, Washington, 1878.)

THE Tenth Annual Report of this extensive and exhaustive Survey is fully worthy of its predecessors, and bears testimony that there is no want of care, attention, and energy on the part of the Department over which Mr. Hayden has presided.

It contains the subsidiary reports of Messrs. C. A. White, F. M. Endlich, and A. C. Peale, on the Geology of a portion of North-Western Colorado, the White River Division, and the Grand River district; and reports also on the triangulation and survey of the districts under examination, the value of the arable and pasture land for cultivation, and a most interesting treatise on the archæological remains.

The Geological series described embraces the Tertiaries of Unita, Bridger, Green River, and Wahsatch, comprising beds of coarse friable sandstones and conglomerates; the Post-Cretaceous of Laramie, containing carbonaceous layers and beds of coal, intercalated with reddish, ferruginous, and yellowish sandstones; the Cretaceous beds of Fox Hills, Colorado, and Dakota, containing clayey and sandy shales; the Jura-Trias of different coloured sandstones, with calcareous fossiliferous rock; and lastly the Carboniferous strata, consisting of sandy and calcareous beds, with masses and nodules of chert, compact bluish fossiliferous limestone, sandstones, sandy limestones, and hard and often quartzitic brick-red sandstones. These rest on the Weber quartzite. The sections and outline illustrations of these strata are most admirably rendered; and a further series of sketches of the weathered and eroded sandstones forming "monuments," such as the "Happy Family" group in the White River Cañon, are also given. Speaking of the latter, Mr. Endlich observes, "The most frequent form exhibited is one closely imitating ruins of some ancient building or city. Seen by the slanting rays of a setting sun, the hills seem fortified, each by a castle of enormous dimensions, that throws a long-drawn shadow to the eastward. Turrets and battlements are supplied by the skilful hand of nature, that teach, by their form, the source whence human ingenuity copied them."

It is also advanced that, though the cañons have been mainly carved out by water-action alone, there seem to be indications of ice-action in the marking out of their original directions, though the softness and friability of the rock materials would prevent any direct traces being found now.

An excellent monograph on the erupted rocks of Colorado, and a catalogue of the minerals found in Colorado, add much to the value of the volume; but perhaps the most interesting portion is that contributed by Mr. William H. Holmes, on the archæology of the districts surveyed. They seem even more extensive than those previously described, but occupy the same positions as in other parts of the Colorado, that is, rock-shelters and caves, situated high up on the steep sides of the valleys, and improved by the addition of masonry into terraces, walls, and houses. Although the country is, generally speaking, dry and barren, and seems almost incapable of supporting a population so extensive, apparently, as that which originally occupied it, the streams and springs, near which the remains are exclusively found, are bordered by grass-covered bottoms and alluvial tracts: and these, if perfectly utilized, would afford a considerable area of rich tillable land.

As a rule, the buildings are of regular form, that is (where the ground permits), either in perfect circles or perfect squares; and in the larger towers the space between the outer walls is divided by heavy partition-walls into a number of apartments, with a circular depression or *Estufa* (or council-house) in the centre. Quantities of flint chips, and fragments of pottery, were found in the neighbourhood of the habitations. The fictile fragments are richly marked,

in black or red, on a greyish or yellowish ground, with lined or geometric patterns; while in many cases the clay vessel was rudely modelled into the form of birds.

One skull, found in the Chaco Cañon, among ruins situated on the alluvial floor of the valley, is believed to have belonged to the ancient Pueblo Indian race. It is that of a female. The most striking feature of the cranium being the great flattening of its posterior portion, "including the anterior portion of the occipital and the posterior-superior portions of the parietal bones." From the appearance of the bones this does not appear to have been a post-mortem deformation.

Numerous pictorial rock-inscriptions are either chipped into the rock or painted in white or red clay; but among the numerous figures so depicted are none that resemble the horse.

The volume concludes with a lengthy catalogue of the Cretaceous and Tertiary plants of North America. C. Cooper King, F.G.S.

III.—Report on the Geology of the Henry Mountains. By G. K. Gilbert. (Washington, 1877.)

TEN years previous to the publication of this work, the district described therein was comparatively unknown, no mention being made of it in any of the published accounts of exploration in the Rocky Mountain region. The name of Henry Mountains was given by Prof. Powell during his journey in 1869 down the Colorado, on the right bank of which river they are situated between two of its tributaries, the Dirty Devil and the Escalante. Although occasionally visited, no regular survey of these mountains was made until that undertaken in 1875–76 by Mr. H. G. Graves and the author of this volume.

The Henry Mountains do not form a continuous range, but consist of a series of five isolated mountains (described in chapter ii.) rising from the plain below to heights varying from 1500 to 5000 feet; the general elevation averages about 11,000 feet above the sea-level. They consist of Cretaceous, Jura-Trias, and Carboniferous strata, with associated intrusive masses and veins of trachyte. It is to the manner in which the trachyte has intruded into, and affected the sedimentary strata, that the peculiar physiognomy of their present appearance is primarily due, and which is fully described in the chapter on "The Laccolite." According to the author the trachytic lava, "instead of rising through all the beds of the earth's crust, stopped at a lower horizon, insinuated itself between two strata, and opened for itself a chamber by lifting all the superior beds. In this chamber it congealed, forming a massive body of trap." For this body the name *laccolite* (λακκος, *cistern*, λιθος, stone) has been used.

The dome-shaped elevation of the original horizontal strata, by the injection from below of a mass of molten matter, has produced the type of structure exemplified in the Henry Mountains, modified of course as to the surface features by the various subaerial agencies which have acted since their upheaval, the effects of which agencies Mr. Gilbert has clearly treated under the head of Land Sculpture.